GammaRAE II Responder

Intrinsically Safe Personal Radiation Monitor and Dosimeter

User's Guide

P/N 047-4404-000
Revision A, June 2006

Read Before Operating

This manual must be carefully read by all individuals who have or will have the responsibility of using, maintaining, or servicing this product. The product will perform as designed only if it is used, maintained, and serviced in accordance with the manufacturer's instructions.

⚠ CAUTION!

To reduce the risk of electric shock, turn off power and remove batteries before removing the monitor cover. Never operate this monitor while the cover is removed. Remove monitor cover and sensor modules only in an area known to be non-hazardous.

⚠ WARNING

To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

⚠ WARNING

Do not mix old batteries with used batteries or mix batteries from different manufacturers.

⚠ WARNING

Substitution of components may impair intrinsic safety.

Contains Transmitter Module
FCC ID: S22BTMODULE-CL2

This product complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including intereference that may cause undesired operation.

Warnings

For safety reasons, this equipment must be operated and serviced by qualified personnel only. Read and understand the user manual completely before operating or servicing.

Computer Interface

Do not transfer data by means of the Bluetooth interface in hazardous atmospheres.

Static Hazard

Clean only with a damp cloth.

Long-Term Storage

Reliable performance of this radiation detector is based upon regular usage. For long-term storage, the battery should be disconnected. Preparation for use after long storage requires installation of the batteries and a warm-up period of at least 10 minutes for the sensors to equilibrate. The user should recognize that sensor life is based upon the purchase date.

⚠ Avertissements ⚠

Pour des raisons de sécurité, cet équipement doit être utilisé, entretenu et réparé uniquement par un personnel qualifié. Étudier le manuel d'instructions en entier avant d'utiliser, d'entretenir ou de réparer l'équipement.

⚠ Câble de Computer

Ne transférez pas les données au moyen de l'interface de bluetooth en atmosphères dangereuses.

⚠ Danger Risque D'origine Electrostatique

Nettoyer uniquement avec un chiffon humide.

⚠ Stockage à Long Term

Le fonctionnement durable de ce détecteur de rayonnement est conditionné par une utilisation régulière de celui ci. Lors d'un stockage à long terme, la batterie doit être déconnectée. Le rédémarrage aprés une longue période d'arrêt, nécessite la réinstallation de la batterie, et une période de chauffage de 10 mn afin que les capteurs se mettent à l'équilibre. L'utilisateur doit être conscient que la durée de vie indiquée pour le capteur démarre à sa date d'achat.

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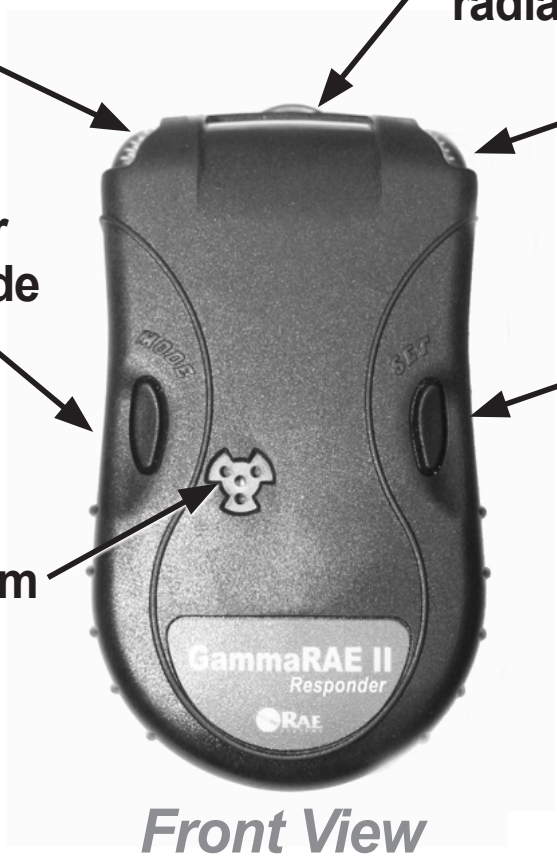
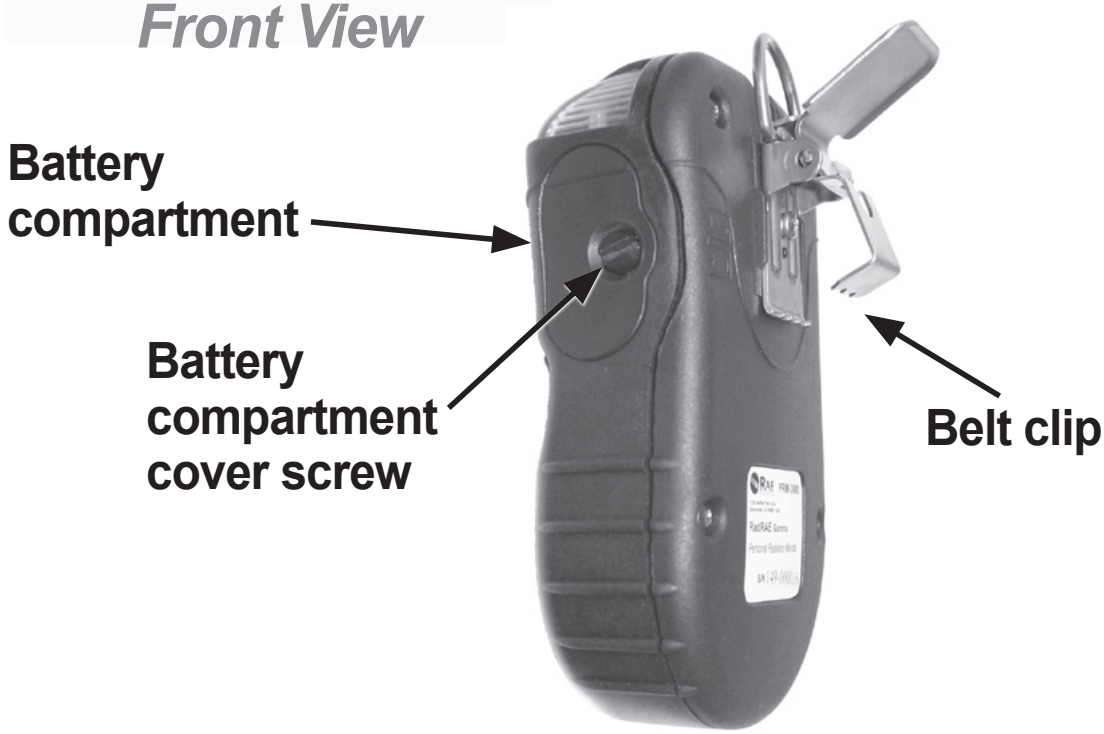
GammaRAE II Responder Features



Front View



Rear/Side View

General Information

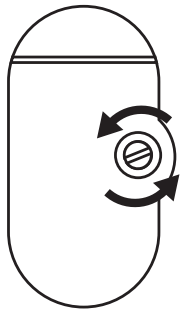
The GammaRAE II Responder is a rapid γ-ray (gamma) source detector and dosimeter in a single unit. Because of its high sensitivity at low radiation levels, it can alert first responders to the presence of a radiation threat well before they might be exposed to health-threatening levels. Its high range and dosimeter functionality also allow first responders to accurately track their dose at higher levels of radiation. It is the only intrinsically safe personal radiation monitor with a loud audible alarm, big, bright flashing LEDs, and a vibration alarm. For stealth operations, law enforcement personnel can disable each alarm separately.

GammaRAE II Responder's water-resistant design makes for reliable operation in wet environments. Its sensitive Cesium Iodide (CsI) scintillator and energy-compensated PIN diode provide fast (less than 2 seconds) response to radiological threats.

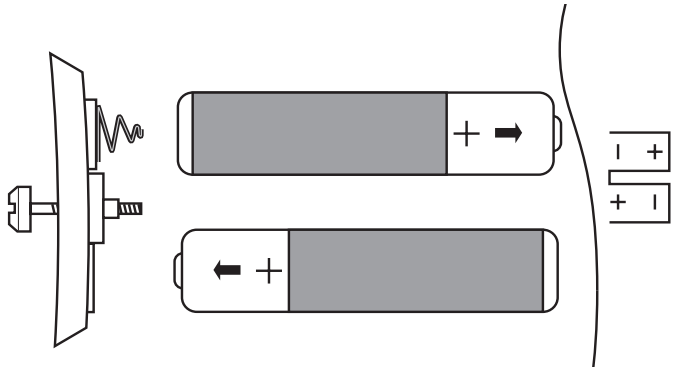
The GammaRAE II Responder accumulates accurate, energy-compensated dosage. Stored dosage data can be cumulative or cleared and reset for each use period.

Inserting & Replacing Batteries

GammaRAE II Responder uses two AA alkaline batteries as its power source (use only Duracell MN1500 or Energizer E91). To change the batteries:

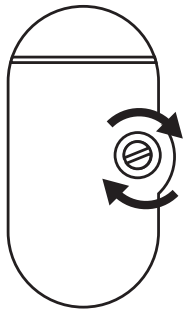


1. Use the provided tool to open the cover on the side of the unit. Turn the screw counterclockwise to loosen the screw, and then tilt the cover off.



2. Insert batteries into the compartment according to the legend on the rear of the GammaRAE II Responder, making sure the batteries' polarity is correct.

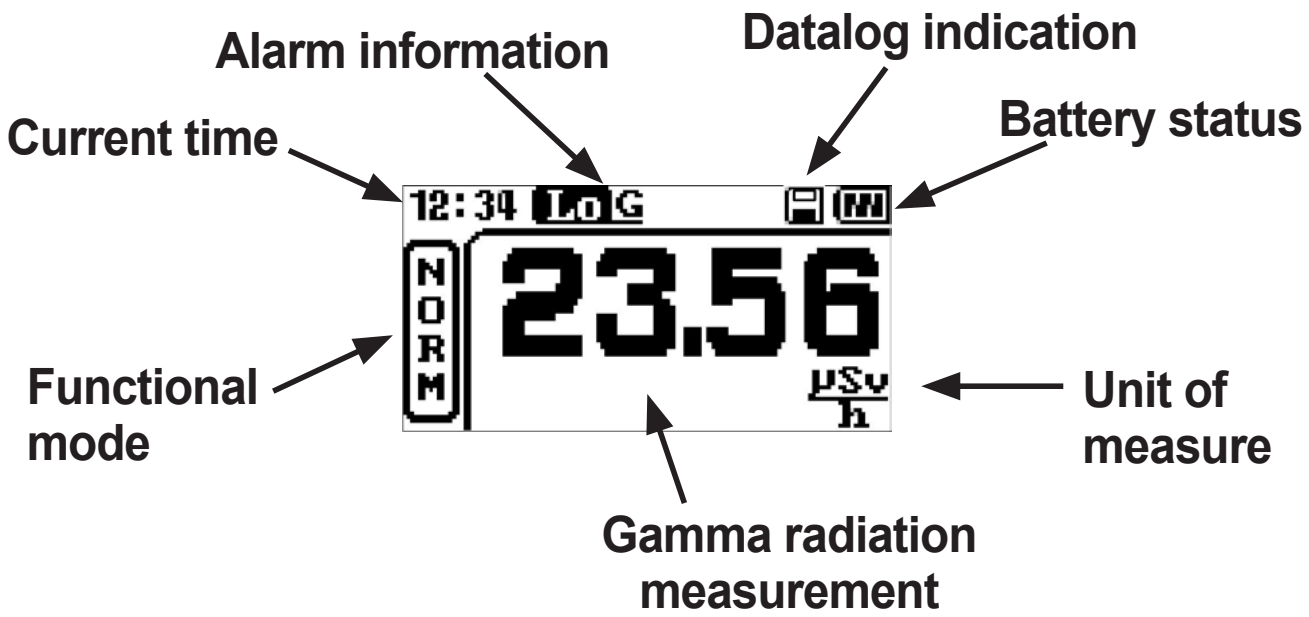
3. Replace the cover and turn the screw clockwise to secure the cover.



User Interface

GammaRAE II Responder's user interface consists of the display, LEDs, alarm transducer and two buttons, labeled MODE and SET. The LCD display provides visual feedback that includes time, functional mode, battery condition, and gamma radiation measurement.

LCD display



MODE and SET switches

User Interface Icons

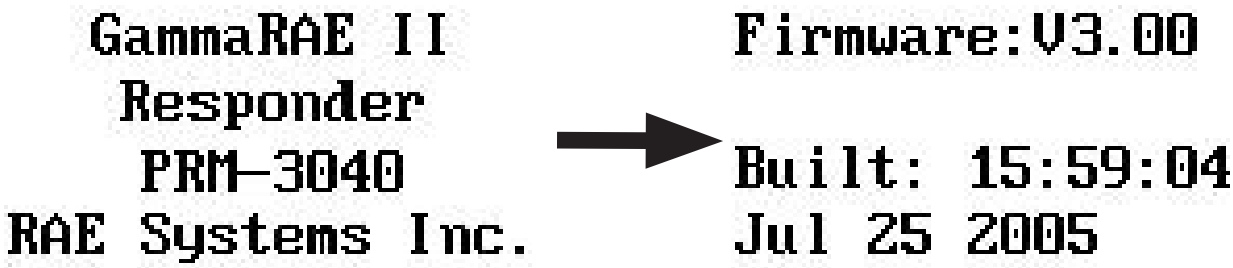
Icon	Indication
	Battery Voltage low Battery Low alarm triggered
	Battery fully charged
	Low Gamma alarm triggered
	High Gamma alarm triggered
	Gamma Over-Range (reading over 10 R/h)
	Gamma Overload. Reading more than two times over-range
	Datalogging active (flashing)

Turning GammaRAE II Responder On and Off

Turning GammaRAE II Responder On

Press and hold the MODE button for 3 seconds. As GammaRAE II Responder starts up, the following occur:

1. A long beep sounds (if the buzzer is set to On), and unit information and the current firmware version are displayed. The LEDs and vibrator undergo a self-test.

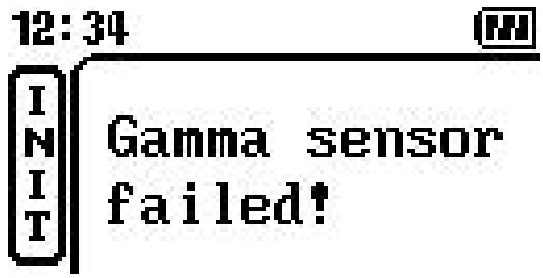


Important! If your GammaRAE II Responder displays "Gamma sensor failed" or "All sensors failed!" contact your distributor or RAE Systems service at +1-408-952-8200. Do not attempt to use or repair the unit. There are no user-serviceable parts in the GammaRAE II Responder.

2. Unit self-check. The time and battery status are displayed:

During the 20-second self-check, the detector checks that the low gamma sensor (scintillator) is functioning properly. If so, the message "Gamma sensor OK!" is displayed.

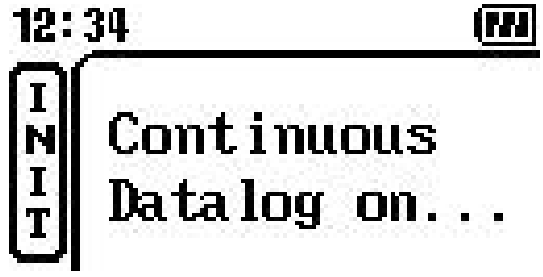
If the low gamma sensor is damaged or not functioning properly, the message “Gamma sensor failed" is displayed, turn the unit off and contact your distributor or the RAE Systems service department.



The high gamma sensor (PIN diode) is also tested continuously for the first 30 minutes of operation. If the high gamma sensor is damaged or not functioning properly, the message "HiGamma sensor failed" is displayed, turn the unit off and contact your distributor or the RAE Systems service department.

3. The datalog type is displayed, followed by the alarm mode. These parameters can be changed in Programming Mode, described later in this guide.

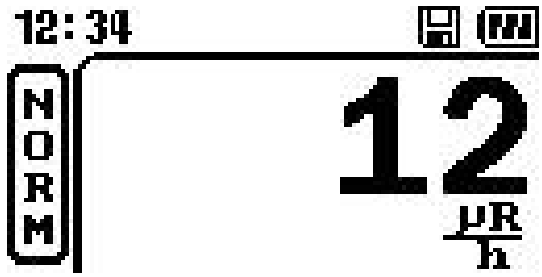
or



or

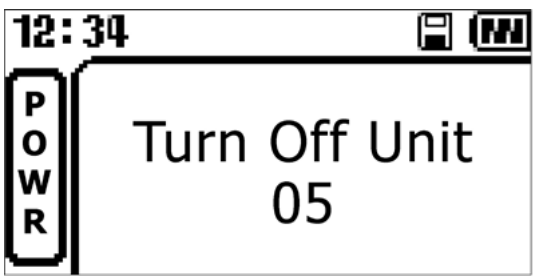
4. Background calibration reading (Search Mode only). The GammaRAE II Responder performs a 36-second background reading countdown.

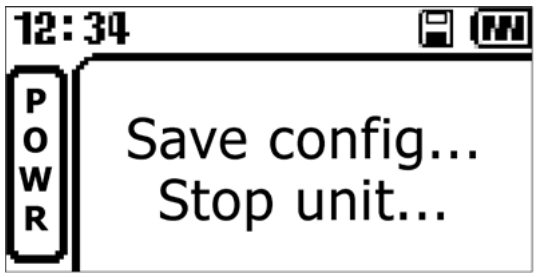
When background calibration reading is complete, datalogging starts (if Continuous Datalogging is enabled) and the unit is in Normal Operating Mode. The display looks like this:



Turning GammaRAE II Responder Off

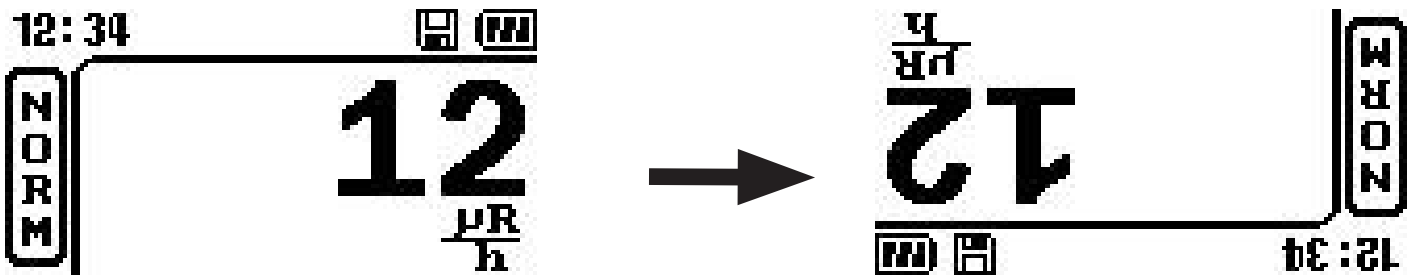
Press the MODE button and hold it for 5 seconds. The detector counts down 5 seconds and then turns itself off. Do not release the MODE button until the unit counts down to zero and the display reads “Save config...” and “Stop unit...”





Flipping the Screen

The GammaRAE II Responder is easy to read, whether held in the hand or clipped to a belt. To flip the screen, press the SET button and hold it down for 3 seconds. When the image inverts, release the button.



To flip the display again, hold SET for 3 seconds.

Operation

The GammaRAE II Responder has two modes: Normal Operating Mode and Programming Mode. Normal Operating Mode is the default; see Programming Mode, on page 20, for details on entering and using Programming Mode.

Normal Operating Mode

In Normal Operating Mode, the GammaRAE II Responder detects gamma radiation and accumulates radiation dosage data. In Normal Operating Mode, pressing the MODE button sequentially steps the unit through the following functions:

NORM	Normal Operating Mode
BGND	Background calibration (only in Search Mode)
PEAK	Maximum radiation level detected since last cleared
MIN	Minimum radiation level detected since last cleared
DOSE	Accumulated radiation dosage since last cleared
TIME	Time, date, and time unit has been on
STAT	Detector status (battery voltage and internal temp.)
COMM	Open Bluetooth® communication with computer
TEST	Self test (if Diagnostic Flag is set during start-up)

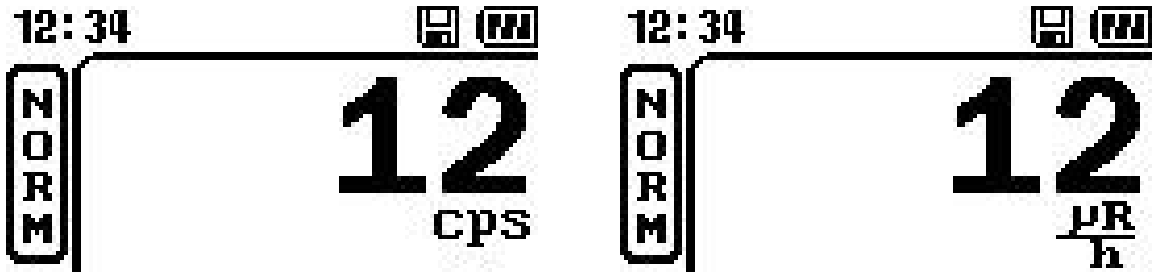
Each function remains active for 60 seconds before automatically returning to the Normal Operating Mode. Pressing the MODE button changes the selection from one function to the next one in the sequence.

The BGND, PEAK, MIN, DOSE, TIME, STAT and TEST screens can each be enabled or disabled using the ProRAE Studio Radiation software. The NORM and COMM screens are always enabled.

NORM

Normal Operating Mode of the GammaRAE II Responder.

Displays a measurement of the ambient radiation. Can display in counts per second (cps) or divisions of R/h or Sv/h, depending on how the detector is set up (see Programming Mode). Switch back and forth between units by pressing the SET button.



Press the MODE button to step to the next function.

BGND

Background reading. This option is only active if the GammaRAE II Responder is in Search Mode. This option is skipped if the detector is in Safety Mode.

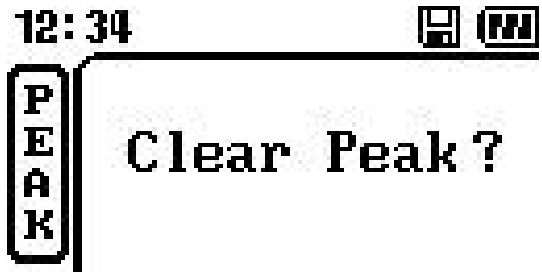
Press the SET button to have the detector update the background radiation reading.

Press the MODE button to step to the next function.

PEAK

The maximum radiation level detected since last cleared.

Press the SET button twice to clear the PEAK value. If you press SET once but do not want to clear the reading, press MODE to return to the PEAK reading. The PEAK value is also cleared when the detector is turned off.



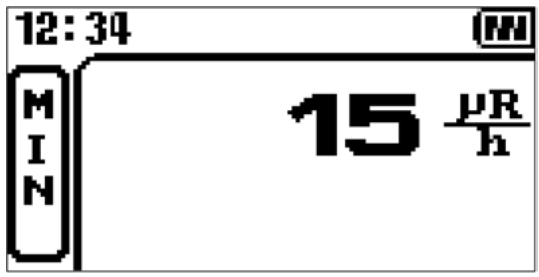
Press the MODE button to step to the next function.

MIN

The minimum radiation level detected since last cleared.

Press the SET button twice to clear the MIN value. If you press SET once but do not want to clear the reading, press MODE to return to the MIN reading.

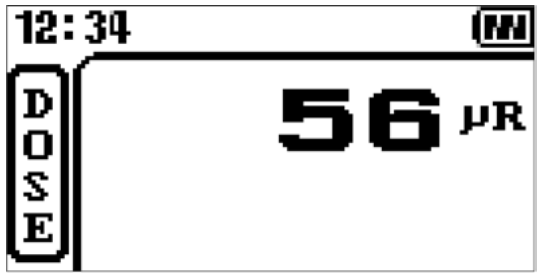
The MIN value is also cleared when the detector is turned off.



Press the MODE button to step to the next function.

DOSE

The total radiation dose since last cleared.
Press the SET button twice to clear the DOSE value. If you press SET once but do not want to clear the DOSE reading, press MODE to return to the DOSE reading.

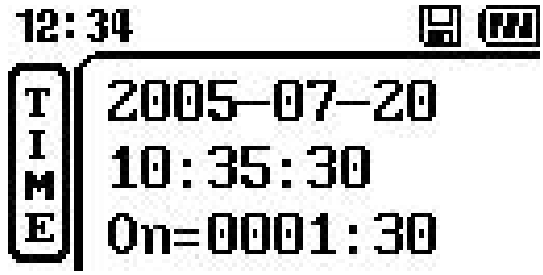


Press the MODE button to step to the next function.

TIME

Time, date, and run time. Date is displayed in YYYY-MM-DD format (can be set in Programming Mode). Time is displayed in HH:MM:SS format (can be set in Programming Mode).

On Run time from when the detector was turned on (shown in hours and minutes, 0000:00).



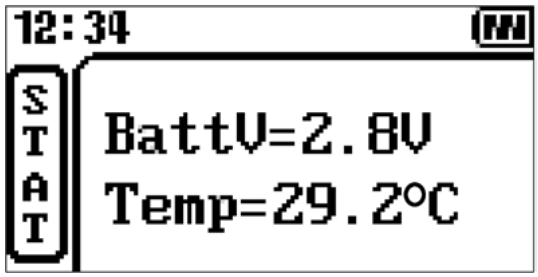
Press the MODE button to step to the next function.

STAT

Detector status.

BattV Battery voltage

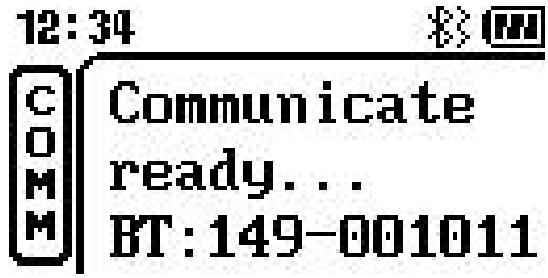
Temp Internal temperature (can be displayed in °C or °F – see Programming Mode).



Press the MODE button to step to the next function.

COMM

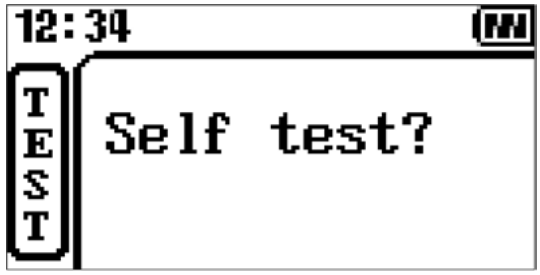
Communicate with a computer using Bluetooth® radio. Press SET to open the connection on the GammaRAE II Responder unit end.



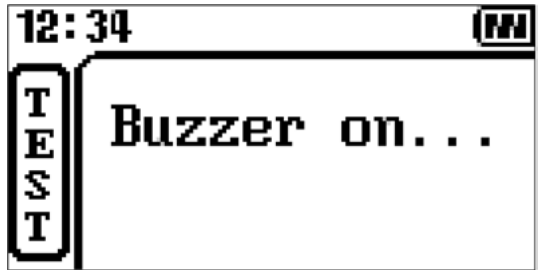
Use the ProRAE Studio Radiation Software on your computer to download datalogs and change configuration settings.

TEST

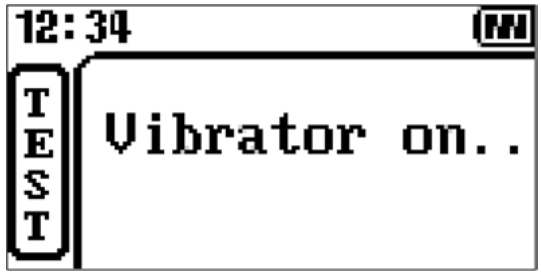
Self test. This consists of tests to make sure all alert functions are working properly. This function is only enabled if the Diagnostic Flag was set at start-up, and Diagnostic Mode is allowed in ProRAE Studio Radiation. To set the Diagnostic Flag, press and hold SET and MODE simultaneously when turning the unit on, instead of pressing MODE only.



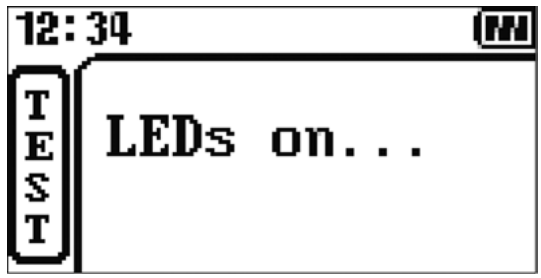
Press the SET button to accept and to initiate testing. The Buzzer is tested. Press the SET button to start the next test.



The Vibrator is tested. Press the SET button to start the next test.

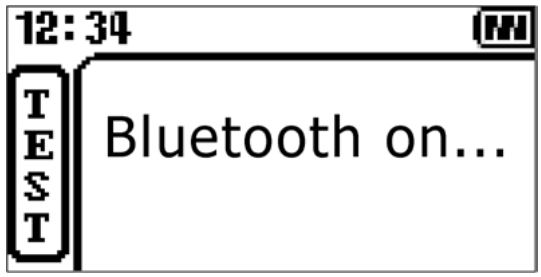


The LEDs are tested. Press the SET button to start the next test.

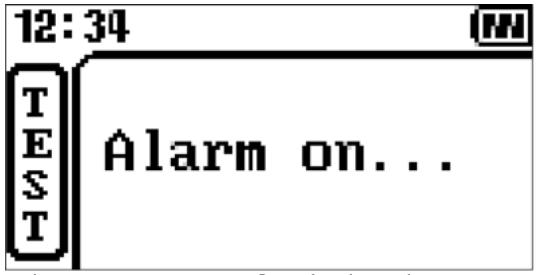


The back light is tested. Press the SET button to start the next test.

The Bluetooth® radio is tested. Press the SET button to start the next test.



The Alarm Alerts are tested.



Press the SET button to finish the TEST functions. This returns GammaRAE II Responder to Normal Operating Mode. During any test, if the SET button is not pressed within 60 seconds, the unit automatically moves on to the next test.

Programming Mode and Basic User Mode

Programming Mode and Basic User Mode are used to change alarm settings and detector settings (units of measure, time, etc.). All options are available in Programming Mode, and it is password protected for security and use in larger organizations, while only a portion of the settings are changeable in Basic User Mode. No password is required for Basic User Mode.

Note: Changes to some parameters cause the detector to automatically restart or recalibrate.

From Normal Operating Mode, simultaneously press the MODE button and SET button, and hold them down for 3 seconds. The password entry screen is shown:

Enter the password by pressing the SET button to increment each digit, and the MODE button to move to the next digit. The default password is 0000, and can be changed using the ProRAE Studio Radiation software. Select OK to go into Programming Mode. Select Skip to go into Basic User Mode, and Cancel to return to Normal Operating Mode.

The main menu for Programming Mode or Basic User Mode is displayed:

Press the MODE button to step through the menu of parameters. Press the SET button to select a parameter.

The following options are from the main menu in Basic User Mode:

Alarm Type	Alarm Alerts
Datalog Type	Backlight
Temp Unit	Gamma Unit

The following options are from the main menu in

Programming Mode:

Alarms	Basics
Datalog	Defaults

The screens to change the options in Basic User Mode are the same as those shown in Programming Mode, detailed later.

Alarms

Select Alarms to set the alarm mode or type and the detection limits for the alarm:

Parameter	Used In
Alarm Type	Select Search or Safety Mode
Alarm Alerts	Both
Search Alarm	Search Mode
Safety High	Safety Mode
Safety Low	Safety Mode
Dose Alarm	Both
Quit	

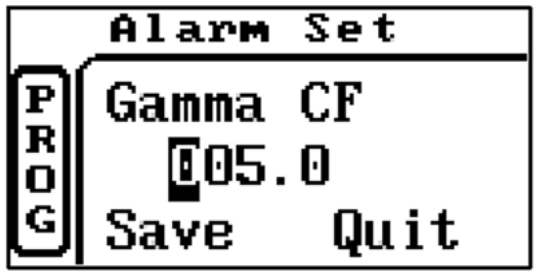
The Search Alarm is used to set the Search Mode Alarm at a calculated percentage above background.

The alarm is set according to:

$$\text{Search Mode Alarm} = (\text{Search Alarm}) * \sigma_{bk}$$

where σ_{bk} is the standard deviation of the stored background reading.

To set each alarm, press the MODE button to highlight the desired alarm, then press the SET button to select it.



Press the MODE button to step through the digits from left to right. Use the SET button to increment each digit (from 0 through 9). Units can also be selected for the Safety High, Safety Low and Dose Alarms. Highlight the unit using the MODE button, then press the SET button to choose the unit.

Press the MODE button to highlight and the SET button to select Save (to save changes) or Quit (to discard changes).

To exit the Alarms menu, step through the options using the MODE button until you see Quit. Press the

SET button to exit Alarm Set, and then step through the Main Menu until you see Quit. Press SET to exit Programming Mode and return to Normal Operating Mode.

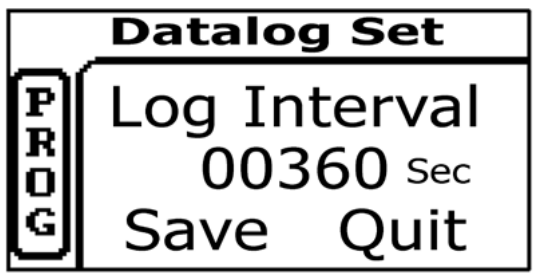
Datalog

Select Datalog to change any of the following datalog parameters:

Datalog Type	Datalog Period
Clear Data	Quit

Clear Data: Press the SET button to clear the datalog. Press the MODE button to return to the Datalog Set Menu.

Datalog Period: Set the time interval between datalog points. You may set any time interval between 1 and 3600 seconds. Press the MODE button to step through the digits from left to right. Use the SET button to increment each digit (from 0 to 9). Select Save to save changes or Quit to discard changes.



Datalog Type: Set the type of datalogging. Choices are Continuous or Event-driven. Choose Continuous to log data at a set interval at all times (except when the unit is Programming Mode). Choose Event-driven to log data only when the dose rate readings increase or the unit goes into alarm.

Quit: To exit the Datalog menu, step through the options using the MODE button until Quit is selected. Then press the SET button.

Basics

Select Basics to change any of the following parameters:

Backlight	Temp Unit
Gamma Unit	Change Date
Change Time	Quit

Press the MODE button to step through these options.

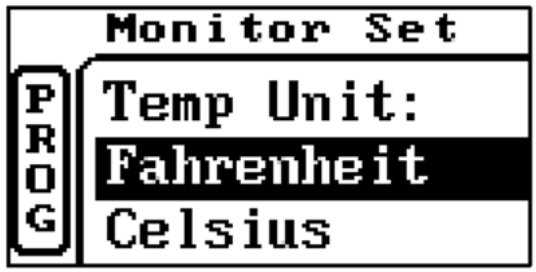
Select an option using the SET button. Once you have selected a menu option, step through the submenu options using the MODE button, and select using the SET button.

Backlight

Set the behavior of the display backlight. Choices are Automatic (a photosensor turns on the light in dark locations), Manual (light stays on for 15 seconds when you press a button), or Off.

Temp Unit

Set the unit of measure. Choices are Fahrenheit and Celsius. Press MODE to select Fahrenheit or Celsius. Then press SET to save your choice and exit.

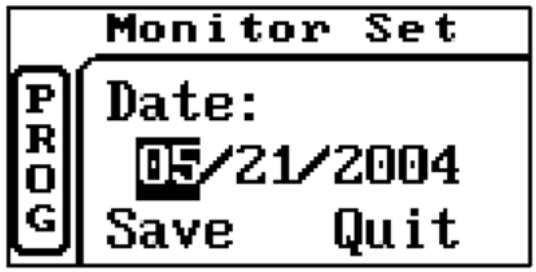


Gamma Unit

Set the unit of measure (of gamma radiation). Choices are µR/h or µSv/h. Press MODE to select your choice, and then SET to save your choice and exit.

Change Date

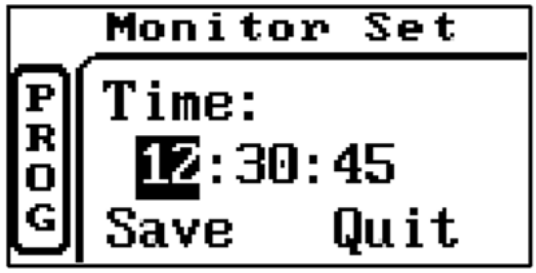
Set the date (mm/dd/yyyy). Press MODE to step through month, date, and year, and press SET to increment through the digits (holding the SET button continuously speeds through the numbers).



Press MODE to select Save, and press SET to save your date changes. Otherwise, press MODE again to select Quit and press SET to exit.

Change Time

Set the time (hh/mm/ss). Press MODE to step through hours, minutes, and seconds, and press SET to increment through the digits (holding the SET button continuously speeds through the numbers). **Note:** The clock operates in 24-hour mode only.



Press MODE to select Save, and press SET to save your time changes. Otherwise, press MODE again and select Quit. Press SET to exit.

Quit

To exit the Basics menu, step through the options of Monitor Set until you see Quit. Press the SET button to exit Monitor Set. Then step through Main Menu

selections using the MODE button until you see Quit. Press SET to exit Program Mode and return to Normal Operating Mode.

Defaults

Select Defaults to restore the factory default settings.

Press SET to restore the default settings, and MODE to cancel and keep the current settings.

GammaRAE II Responder Default Settings & Parameter Ranges

Main Menu	Sub Menu	Default Settings	Data Range
Alarms	Alarm Type	Search	Search/Safety
	Alerts	All on	All on
			Buzzer+Light
			Vib+Buzzer
			Buzzer only
			Vib+Light
			Light only
			Vib only
	Search Alarm	5.8	1.0 to 9.9
	Safety High	200 µR/h	0 to 10 R/h 0 to 0.1 Sv/h
	Safety Low	50 µR/h	0 to 10 R/h 0 to 0.1 Sv/h
	Dose Alarm		

Datalog	Clear Data	N/A	N/A
	Datalog Type	Continuous	Continuous or Event-driven
	Log Interval	60 sec.	1 to 3600 sec.
Basics	Back Lite	Manual	Automatic
			Manual
			Off
	Temp Unit	Celsius	Fahrenheit
			Celsius
	Gamma Unit	µR/h	µR/h
			µSv/h
	Change Date		MM/DD/ YYYY
	Change Time		HH/MM/SS

GammaRAE II Responder Specifications*

Size	4.92" x 2.68" x 1.38" (125 x 68 x 35 mm)
Weight	11 oz (312 g) with batteries
Detector	3cc CsI(TI) w/ photodiode (low channel) Energy-compensated PIN diode (high channel)
Battery	2 AA alkaline batteries
Battery Runtime	Up to 500 hours
Display	Graphic LCD display with 1.2" x 0.75" (30.5 mm x 19 mm) viewable area; can be flipped for view by wearer or by others; cps or dosage rate in (µ,m)R/hr or (µ,m)Sv
Key Pad	2 operation/program buttons
Direct Readout	Dose rate, peak rate, min rate, total dose, battery status, time, time on, temp
Alarms	Loud 85+ dB @ 12" (30 cm) for noisy environments
	Built-in vibration alarm
	Highly visible LED lights on both sides of LCD graphic display

Specifications continue on next page

Specifications (continued)

Backlight	Automatic, manual on or off
Calibration	Periodic functional test recommended using 1μCi and 16μCi ^{137}Cs check sources. Factory calibration available if needed.
Alarm Setting	Password-protected programmable alarm sensitivity with background compensation to minimize innocent alarms
Alarm Modes	Audible and internal vibration alarms; separately enabled or disabled; automatic reset **Search Mode**: Alarm threshold set at a percentage above background reference reading **Safety Mode**: User-set high and low absolute alarm levels
Datalog	30,000 datapoints (20 days @ 60-sec. intervals), wraparound log
Datalog Modes	**Continuous:** Logs data continuously **Event Driven:** Begins logging on alarm
Log Interval	User-programmable (1 to 3600 sec.)

Communi-cations	Built-in Bluetooth® radio
Ergonomics	Nonslip rubber housing with grippable ridges securely fits hand or glove
Energy Range	0.06 to 3.0 MeV
Dose Equivalent Rate (DER) range for ^{137}Cs	1 µR/h to 10 R/h (0.01 µSv/h to 0.1 Sv/h)
Accuracy of DER for ^{137}Cs	±20%
Dose Range	1 µR to 999 R (0.01 µSv to 9.99 Sv)
Temperature	-20° C to 50° C (-4° F to 122° F)
Humidity	0% to 95%
Shock Resistance	Passes drop test from 1.5m (59")
IP Rating	IP67
Attachments	Rugged metal belt clip and wrist strap;
Certification	Intrinsically safe; CSA Class I, Division 1, Groups A, B, C, D, T4 US/Canada CE 0344 Ex II 1G EEx ia IIC T4 KEMA 05 ATEX 1173

*Specifications are subject change.

Limited Warranty

RAE Systems Inc. warrants GammaRAE II Responder to be free from defects in materials and workmanship for a period of 1 year. This warranty is expressly limited to the original owner who purchases the equipment directly from RAE Systems or from an authorized RAE Systems reseller. To validate this warranty the original Warranty & Registration Card supplied with the product must be completed and returned to RAE Systems, or the product registered online via the RAE Systems, Inc. online registration system, within 30 days of purchase.

To maintain this limited warranty, the product must be operated, calibrated and maintained in accordance with the Operation and Maintenance Manual supplied with the product. Abuse, mechanical damage, alteration, and/or repair procedures not made in accordance with the Operation and Maintenance Manual voids the RAE Systems Standard Limited Warranty.

The obligation of RAE Systems under this limited warranty is limited to the repair or replacement of components deemed by the RAE Systems Instrument Service Department to have been defective under the scope of this Standard Limited Warranty. To receive consideration for warranty repair or replacement procedures, products must be returned to RAE Systems at its manufacturing location in San Jose, California,

USA, with transportation and shipping charges prepaid. It is necessary to obtain a return authorization number from RAE Systems prior to shipment.

This limited warranty is expressly in lieu of any and all representations, express or implied, including but not limited to, the warranty of fitness for a particular purpose. RAE Systems will not be liable for loss or damage of any kind connected to the use of its products or failure of its products to function or operate properly.

Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

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Please note - Product designs and specifications are subject to change without notice. The user is responsible for determining the suitability of this product.